termination of labours which must have occupied most if not all of his leisure time from other more regular work.

But Mr. Carr has not confined his work to the limits of his previous title-pages: he has "supplemented" it "by an index to the papers on pure mathematics which are to be found in the principal Journals and Transactions of learned Societies, both English and foreign, of the present century." Such indices have, in these busy times, great value for students in all branches of knowledge, and this one is, we think, very accurate for a first edition. There are, however, some defects. On p. 720 occurs an historical note on the cycloid; no reference is made to the exhaustive treatise, on the cycloid and all forms of cycloidal curves, by Mr. Proctor (Longmans, 1878). In the like case of Cartesian ovals there is no account taken of Prof. Williamson's paper on these curves in Hermathena (No. iv. p. 509; subsequently given in the author's "Differential Calculus"). For the length of an arc of an oval expressed by elliptic functions, Mr. Carr (p. 731) cites a paper by Mr. S. Roberts, F.R.S., in the London Mathematical Society's Proceedings (vol. v. p. 6), but does not mention that Mr. Roberts (vol. vi. p. 200) subsequently found that he had been anticipated by Prof. Genocchi (1855, see "Il Cimento," Turin). The name of Desargues, rightly given p. 917, is twice printed Desarques on p. 858. On pp. 913 and 935 we have "polyzonal," "zonal," and "tetrazonal": the author of the paper in question has "m" in place of "n" throughout. "Nicomaque" (p. 853), "implexe" (p. 859), "pseudosfera" (p. 915), are easily traceable; "coplanation" and "complanation" are also to be traced to the titles of the original papers. Cases of wrong spelling occur in the names of Hesse (p. 890), Kronecker (p. 890), Plücker (p. 916), Rodrigues (p. 921), Lissajous (p. 900), and there are various forms of MacCullagh; but "Tetratops" (p. 931) eludes us. These are trifling matters, and in the text in such parts of XIII. and XIV. as we have read we have not observed any errata of consequence.

It would be a boon to students if Mr. Carr would issue this supplement in a separate form, and add to his extensive list of thirty-two periodicals references to the papers on pure mathematics which occur in the *Philosophical Magazine*, *Lady's and Gentleman's Diary*, the *Mathematician*, "Reprint from the *Educational Times*" (a limited selection here of general results and the occasional papers), and *Mathesis*. For instance, on the "15-girl" problem there is a good article in the *Diary*, on the "chessmen" in the *Philosophical Magazine*.

Mr. Carr will understand that our remarks are made in no captious spirit: we are very grateful for the trouble he has taken, and desire only that a second edition may be made even more valuable from its increased accuracy and stores of information than the present one is.

He is to be congratulated on the arrangement of his text, the several different kinds of types which have been put at his disposal by the printers, and the excellent diagrams. It only remains to express the wish that what the author has done for one side of mathematics he may be encouraged to do for the other, *i.e.* for applied mathematics.

COMMERCIAL ORGANIC ANALYSIS

Commercial Organic Analysis. By Alfred H. Allen, F.I.C., F.C.S., &c. Second Edition, Revised and Enlarged. Vol. II. Fixed Oils and Fats, Hydrocarbons, Phenols, &c. (London: J. and A. Churchill, 1886.)

THIS work has been so much enlarged and so thoroughly revised that it has become almost a new book, and certainly its value has been greatly enhanced to all analysts and others interested in the special points discussed. These copious additions have rendered it necessary to divide the present edition into three volumes, the first of which appeared some little while ago, whilst the third (on Aromatic Acids, Tannins, Colouring Matters, Cyanogen Compounds, Organic Bases, Albumenoids, &c.), is now in course of preparation, and is promised shortly. Of the sections treated in the present volume it may be said generally that the author has collected together and systematically digested almost all the available information extant scattered about in text-books and numerous papers read before scientific Societies, and that he has largely contributed personally to the mass of information by means of experimental and observational work carried out in his own laboratory at the cost of much time and labour. Moreover, he has sought and obtained the aid of several well-known chemists possessing special knowledge and skill in certain kinds of work, by whose assistance many of the more important articles have acquired an almost exhaustive character. As a result, the treatise has become a most valuable hand-book and book of reference with respect to the class of matter coming within its scope; and it may now be fairly said to be an essential item in the list of works requisite in the library of an analytical chemist.

Amongst the numerous special points of research to which the author has devoted much personal attention, a notable one is the examination of various of the physical properties of fatty and oily matters with a view to their discrimination and identification, and more especially the methods in use in the determination of their specific gravity. In order to avoid complications arising from differences in physical state—some being solid, others pasty, and others fluid at the ordinary temperature—he recommends, as previously proposed by Estcourt, that comparisons should always be made at the temperature of boiling water, the melted fat or fluid oil being placed in a test-tube heated in a water-bath (of such construction that no steam escapes in the vicinity of the operator), and the indications of a Westphal's hydrostatic balance noted when the plummet is immersed in the hot oil. The figures thus obtained on repetition of experiments show very little divergence; and characteristic values are thus obtainable for certain kinds of fats, *e.g.* butter-fat when genuine. Owing to the fact that the Westphal balance as sold is constructed to give specific gravity indications *at the ordinary temperature* (*i.e.* that the plummet is adjusted so as to lose a particular weight, conveniently 5 or 10 grammes, when immersed in water at, say, 15° C.), it is obvious that the numerical values obtained on immersion in hot material at close upon 100° C. represent neither the true densities at 100° of the substances (weights per cubic centimetre) nor the ratios between

©1887 Nature Publishing Group

these densities and that of water at 100°, *i.e.* their specific gravities at 100°. But for any particular instrument, the different values obtained with different fatty matters exhibit the same differences as those obtained with any other instrument; whilst the indications of any two instruments are obviously comparable, provided that the mode of graduation and the coefficient of expansion of the plummet are the same; which practically is the case if a *glass* plummet be always used, as recommended. In a recent communication to the *Analyst* (January 1887, p. 18), the author suggests that the term "*indicated plummet-gravity*" should be employed to represent the apparent values obtained at such and such a temperature by means of the plummet-balance; which is clearly preferable to the use of either of the terms "specific gravity" or "density" in such cases. It may be noticed in passing that the "indicated plummet-gravities" of fats and oils at 100° or thereabouts by no means necessarily follow the same order as the so-called specific gravities obtained at lower temperatures, not only on account of difference of physical state, but also through the different rates of expansion possessed by the various substances.

Another point on which the author has worked with results of some interest is the determination of the amount of glycerol yielded by fats and oils on saponification. He concludes that there is no experimental basis for the suggestion put forth some time ago by Wanklyn and Fox that *isoglycerides* are present in such substances, these bodies yielding on saponification propionic (or other homologous) acid and water, instead of glycerol. Such a view is opposed not only to the author's laboratory experience, but also to that of manufacturers, who frequently recover 7·5 to 8·0 parts of glycerol per 100 of fatty matter, instead of less than 5 as stated by Wanklyn and Fox. Making allowance therefore for deficient saponification and loss of glycerol by evaporation during recovery, the theoretical amount of glycerol obtainable is satisfactorily accounted for, instead of being largely in excess of that actually produced. It is noticeable that, whilst the author obtained results reasonably concordant with the permanganate process for the determination of the glycerol produced during saponification as compared with the other ordinary methods in many instances, this was not always the case, the former process sometimes yielding figures far in excess, indicating the presence of other substances besides glycerol capable of forming oxalic acid by treatment with permanganate. An extreme case was afforded by linseed oil dried up to elastic skin, which gave 4·9 per cent. of impure glycerol directly isolated, and 15·5 per cent. by the permanganate process.

The author considers that the usually received molecular weight of linoleic acid, generally represented as indicated by the formula $C_{16}H_{28}O_2$, is incorrect, as the mean equivalent of the acids obtainable from linseed oil on saponification has been found by him to be considerably higher than that thus indicated. The formula $C_{18}H_{32}O_2$ agrees better with his results, and moreover is not at all incompatible with the analytical data obtained by previous investigators. The analogous determination of the mean molecular weight of the acids produced on saponification (by means of alcoholic potash and phenolphthalein) of fatty, waxy, and oily matters, and of the fatty and resinous acids contained in soaps, is justly regarded by the author as a valuable criterion in judging of the nature of such substances, especially when taken in conjunction with other data (*e.g.* in the case of butter-fat, the amount of volatile acids capable of being subsequently distilled off along with water, working under particular constant conditions as recommended by Reichert; and the proportion between acids soluble and insoluble in water, &c.); and a large amount of experimental work has been done by him in connection with such valuations. He has also made an excellent digest of recent researches in connection with fats, oils, waxes, soaps, and analogous bodies. In connection with toilet-soaps, he regards the addition of sugar to produce transparency as "simply diluting the true soap-material as so much water would do, without communicating any compensating property of value." This is a very mild way of putting the case, the fact being that soaps containing sugar are liable to produce, in sensitive subjects, a great amount of irritation of the skin (in fact, a mild kind of "grocer's eczema," traceable to the same cause), even though free from causticity and otherwise unobjectionable: and numerous persons are, to the reviewer's knowledge, unable to use certain widely-advertised soaps, in consequence of the large admixture of sugar therein contained, although the composition would otherwise be quite uninjurious.

The sections devoted respectively to hydrocarbons and phenols are equally comprehensive, including descriptions, necessarily in some cases somewhat brief, of the leading points in the petroleum, coal-tar, and shale-oil industries, and of the technical examination of the various products obtained on fractional distillation and subsequent further treatment of these and allied raw materials, *e.g.* wood-tar; and the commercial examination of turpentines and resins, essential oils, camphors, and various miscellaneous substances, such as cantharidin and cholesterin. In these, as in the previous section, the value of the various *précis* given of other observers' work is frequently further enhanced by the comparative experiments and examinations made in connection with different analytical methods, &c., by the author himself. Bone-tar, obtained as a by-product of the animal charcoal manufacture, is not described, probably on account of the limited uses to which, hitherto, it has been put; whilst, for similar reasons, but little is said of blast-furnace and coke-oven tars.

C. R. ALDER WRIGHT

OUR BOOK SHELF

Practical Dynamo-Building for Amateurs. By Fred. W. Walker, M.E. (London: Iliffe and Son, 1886.)

WOULD that all books for amateur guidance were written with as full a knowledge of proper principles as this unassuming little work. We are not saying that the machine which the author recommends amateurs to construct is the equal of the commercial dynamos of the current date. His field magnet cores are of cast iron, and not of the best form; his armature might be improved by getting greater cross-section of iron into it. But there is nothing wrongly done. All instructions about the essential details of proper insulation and testing of the work in progress are accurate and full; and an appendix on alternative constructions of field-magnets supplies in some degree the deficiencies of the earlier text.

©1887 Nature Publishing Group